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EXAMINER

YU, LIHONG

ART UNIT

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PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

<b>Office Action Summary</b>	<b>Application No.</b> 10/589,055	<b>Applicant(s)</b> KRUSE, GERHARD	
	<b>Examiner</b> LIHONG YU	<b>Art Unit</b> 2611	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

#### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) ☒ Responsive to communication(s) filed on 04 October 2007.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) ☒ Claim(s) 20-54 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 20-54 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 10 August 2006 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All    b) ☐ Some \*    c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)  | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftperson's Patent Drawing Review (PTO-948)  | 5) <input type="checkbox"/> Notice of Informal Patent Application                       |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)<br>Paper No(s)/Mail Date <u>8/29/2008</u> . | 6) <input type="checkbox"/> Other: _____  |

## **DETAILED ACTION**

### ***Specification***

1. The disclosure is objected to because of the following informalities:  
  
In the Applicant's disclosure, page 5, line 3, the word "MIMI" should have been "MIMO".  
  
Appropriate correction is required.

### ***Claim Rejections - 35 USC § 102***

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

3. Claims 20, 22, 38, 40, 42, 46, 49 and 52 are rejected under 35 U.S.C. 102(e) as being anticipated by Perahia et al (US 7,352,688 B1).

**Consider claims 20 and 42:**

Perahia discloses a method for operating MIMO air interfaces in mobile communication systems (*see Perahia at the Abstract, where Perahia describes an invention for estimating a MIMO wireless communication channel*), the method comprising:

- transmitting from a transmitting device a radio signal over a MIMO channel comprising a number of  $m$  sub channels (*see Perahia at col. 2, lines 8-25, where Perahia describes transmitting OFDM signals in the MIMO channel; see col. 1, lines 42-54, where Perahia describes the MIMO channel has multiple spatial sub-channels*);
- receiving the radio signal (*see Perahia at col. 2, lines 26-40, where Perahia describes receiving the OFDM signals*);
- assigning different polarizations to the signals that are to be transmitted and received on the sub-channels (*see Perahia at Fig. 3 and col. 5, lines 6-15, where Perahia describes that a first spatial sub-channel is mapped to a horizontal antenna polarization and a second spatial sub-channel is mapped to a vertical antenna polarization*);
- mutually conducting to a superimposed antenna the radio signals of all sub channels (*see Perahia at Fig. 3 and col. 5, lines 6-15, where Perahia describes that the signals for the horizontal and vertical antenna polarizations are generated separately in parallel; see Fig. 1 and col. 4, lines 1—21, where Perahia describes that the horizontal and vertical polarizations may be from the same antenna*), the antenna comprising several spatially closely adjacent partial antennas (*see Perahia at Fig. 1*

Art Unit: 2611

*and col. 4, lines 1-34, where Perahia describes two antenna elements represent the horizontal and vertical polarizations of the same antenna, and the two antenna elements form two independent spatial sub-channels).*

**Consider claim 22:**

Perahia discloses the method according to claim 20 above. Perahia discloses governing the assignment of the polarizations of the radio signals sent out on the sub channels by a control facility (*see Perahia at col. 5, lines 5-15, where Perahia describes signals for the horizontal and vertical antenna polarizations are generated separately in parallel*).

**Consider claim 38:**

Perahia discloses the method according to claim 20 above. Perahia discloses determining the polarization of the signals sent out on the sub channels by the relationship of the amounts of its performances  $\alpha$  and/or  $(1-\alpha)$  and/or its mutual phase situation and/or its time offset ( $t_1, t_2$ ) (*see Perahia at col. 5, lines 5-15, where Perahia describes defining antenna element weights corresponding to the two spatial sub-channels*).

**Consider claim 40:**

Perahia discloses the method according to claim 20 above. Perahia discloses the polarizations are switchable and the number of switchable polarizations is at least as large as the number  $m$  of sub channels (*see Perahia at col. 2, lines 15-25, where Perahia describes transmitting the first OFDM signal via a first antenna element while inhibiting transmission of the second OFDM signal via a second antenna element, and vice versa*).

Art Unit: 2611

**Consider claim 46:**

Perahia discloses the device according to claim 42 above. Perahia discloses said facilities comprise means to change the phase situation and/or the time delay (t) of the radio signals (*see Perahia at Fig. 2 and col. 4, lines 45-53, where Perahia describes that blocks 205 shift the frequency and phase of the received signal based on the measured offset for synchronization to local timing*).

**Consider claim 49:**

Perahia discloses the device according to claim 42 above. Perahia discloses said facilities comprise means for dividing the radio signal into several partial signals of various performance a and 1-a (*see Perahia at col. 5, lines 5-15, where Perahia describes defining antenna element weights corresponding to the two spatial sub-channels used to transmit the signal*).

**Consider claim 52:**

Perahia discloses the device according to claim 42 above. Perahia describes a control facility to control the installations (*see Perahia at Fig. 2 and col. 4, lines 45-50, where Perahia describes a controller 207*).

4. Claims 21, 23, 39, 40, 43, 47, 50 and 53 are rejected under 35 U.S.C. 103(a) as being unpatentable over Perahia et al (US 7,352,688 B1) in view of Shnitkin et al (US 3,836,973).

**Consider claims 21 and 43:**

Art Unit: 2611

Perahia discloses the invention according to claims 20 and 42 above. Perahia discloses horizontal and vertical polarization of an antenna on two antenna elements (*see Perahia at col. 4, lines 1-34*). However, Perahia does not specifically disclose the partial antennas have phase centers which coincide.

Shnitkin teaches partial antennas have phase centers which coincide (*see Shnitkin at col. 9, lines 29-33 and col. 10, lines 1-3*).

It would have been obvious to one skilled in the art at the time the invention was made to modify the invention of Perahia, and to have that the partial antennas have phase centers which coincide, as taught by Shnitkin, thus allowing for determining the polarization angle unambiguously, as discussed by Shnitkin (*see Shnitkin at col. 4, lines 30-37*).

**Consider claim 23:**

Perahia in view of Shnitkin discloses the method according to claim 21 above. Perahia discloses governing the assignment of the polarizations of the radio signals sent out on the sub channels by a control facility (*see Perahia at col. 5, lines 5-15, where Perahia describes signals for the horizontal and vertical antenna polarizations are generated separately in parallel*).

**Consider claim 39:**

Perahia in view of Shnitkin discloses the method according to claim 21 above. Perahia discloses determining the polarization of the signals sent out on the sub channels by the relationship of the amounts of its performances  $\alpha$  and/or  $(1-\alpha)$  and/or its mutual phase situation

Art Unit: 2611

and/or its time offset ( $t_1$ ,  $t_2$ ) (*see Perahia at col. 5, lines 5-15, where Perahia describes defining antenna element weights corresponding to the two spatial sub-channels*).

**Consider claim 40:**

Perahia in view of Shnitkin discloses the method according to claim 21 above. Perahia discloses the polarizations are switchable and the number of switchable polarizations is at least as large as the number  $m$  of sub channels (*see Perahia at col. 2, lines 15-25, where Perahia describes transmitting the first OFDM signal via a first antenna element while inhibiting transmission of the second OFDM signal via a second antenna element, and vice versa*).

**Consider claim 47:**

Perahia in view of Shnitkin discloses the device according to claim 43 above. Perahia discloses said facilities comprise means to change the phase situation and/or the time delay ( $t$ ) of the radio signals (*see Perahia at Fig. 2 and col. 4, lines 45-53, where Perahia describes that blocks 205 shift the frequency and phase of the received signal based on the measured offset for synchronization to local timing*).

**Consider claim 50:**

Perahia in view of Shnitkin discloses the device according to claim 43 above. Perahia discloses said facilities comprise means for dividing the radio signal into several partial signals of various performance  $a$  and  $1-a$  (*see Perahia at col. 5, lines 5-15, where Perahia describes defining antenna element weights corresponding to the two spatial sub-channels used to transmit the signal*).



Art Unit: 2611

**Consider claim 53:**

Perahia in view of Shnitkin discloses the device according to claim 43 above. Perahia describes a control facility to control the installations (*see Perahia at Fig. 2 and col. 4, lines 45-50, where Perahia describes a controller 207*).

5. Claims 24, 26, 27, 29 and 32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Perahia et al (US 7,352,688 B1) in view of Witte (US 3,603,987).

**Consider claims 24 and 26:**

Perahia discloses the method according to claims 20 and 22 above. However, Perahia does not specifically disclose altering the polarizations of the signals sent out on the sub-channels in predetermined intervals of time.

In an analogous art, Witte teaches altering polarizations of the signals sent out on sub-channels in predetermined intervals of time (*see Witte at col. 1, lines 40-49, where Witte describes polarization is switched on each pulse period*).

It would have been obvious to one skilled in the art at the time the invention was made to modify the invention of Perahia, and to alter the polarizations of the signals sent out on the sub-channels in predetermined intervals of time, as taught by Witte, thus allowing for achieving polarization diversity, as discussed by Witte (*see Witte at col. 1, lines 40-49*).

**Consider claims 27 and 29:**

Art Unit: 2611

Perahia discloses the method according to claims 20 and 22 above. However, Perahia does not specifically disclose synchronically altering the polarizations of the signal sent out on the sub-channels.

In an analogous art, Witte teaches synchronically altering polarizations of the signal sent out on sub-channels (*see Witte at col. 1, lines 40-49, where Witte describes polarization is switched on each pulse period, therefore, the polarization switching is synchronized with timing of pulse*).

It would have been obvious to one skilled in the art at the time the invention was made to modify the invention of Perahia, and to synchronically alter the polarizations of the signal sent out on the sub-channels, as taught by Witte, thus allowing for achieving polarization diversity, as discussed by Witte (*see Witte at col. 1, lines 40-49*).

**Consider claim 32:**

Perahia discloses the method according to claim 20 above. However, Perahia does not specifically disclose assigning to each signal sent out on the sub channels a polarization selected by chance from a volume of predetermined polarizations.

In an analogous art, Witte teaches synchronically altering polarizations of the signal sent out on sub-channels (*see Witte at col. 1, lines 40-49, where Witte describes that an arbitrarily selected polarization may be selected to be one of a choice of vertical, horizontal, right-hand circular or left-hand circular*).

Art Unit: 2611

It would have been obvious to one skilled in the art at the time the invention was made to modify the invention of Perahia, and to assign to each signal sent out on the sub channels a polarization selected by chance from a volume of predetermined polarizations, as taught by Witte, thus allowing for achieving polarization diversity, as discussed by Witte (*see Witte at col. 1, lines 40-49*).

6. Claims 25, 28, and 33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Perahia et al (US 7,352,688 B1) in view of Shnitkin et al (US 3,836,973), as applied to claim 21 above, and further in view of Witte (US 3,603,987).

**Consider claim 25:**

Perahia in view of Shnitkin discloses the method according to claim 21 above. However, Perahia does not specifically disclose altering the polarizations of the signals sent out on the sub-channels in predetermined intervals of time.

In an analogous art, Witte teaches altering polarizations of the signals sent out on sub-channels in predetermined intervals of time (*see Witte at col. 1, lines 40-49, where Witte describes polarization is switched on each pulse period*).

It would have been obvious to one skilled in the art at the time the invention was made to modify the invention of Perahia, and to alter the polarizations of the signals sent out on the sub-channels in predetermined intervals of time, as taught by Witte, thus allowing for achieving polarization diversity, as discussed by Witte (*see Witte at col. 1, lines 40-49*).

Art Unit: 2611

**Consider claim 28:**

Perahia in view of Shnitkin discloses the method according to claim 21 above. However, Perahia does not specifically disclose synchronically altering the polarizations of the signal sent out on the sub-channels.

In an analogous art, Witte teaches synchronically altering polarizations of the signal sent out on sub-channels (*see Witte at col. 1, lines 40-49, where Witte describes polarization is switched on each pulse period, therefore, the polarization switching is synchronized with timing of pulse*).

It would have been obvious to one skilled in the art at the time the invention was made to modify the invention of Perahia, and to synchronically alter the polarizations of the signal sent out on the sub-channels, as taught by Witte, thus allowing for achieving polarization diversity, as discussed by Witte (*see Witte at col. 1, lines 40-49*).

**Consider claim 33:**

Perahia in view of Shnitkin discloses the method according to claim 21 above. However, Perahia does not specifically disclose assigning to each signal sent out on the sub channels a polarization selected by chance from a volume of predetermined polarizations.

In an analogous art, Witte teaches synchronically altering polarizations of the signal sent out on sub-channels (*see Witte at col. 1, lines 40-49, where Witte describes that an arbitrarily selected polarization may be selected to be one of a choice of vertical, horizontal, right-hand circular or left-hand circular*).

Art Unit: 2611

It would have been obvious to one skilled in the art at the time the invention was made to modify the invention of Perahia, and to assign to each signal sent out on the sub channels a polarization selected by chance from a volume of predetermined polarizations, as taught by Witte, thus allowing for achieving polarization diversity, as discussed by Witte (*see Witte at col. 1, lines 40-49*).

7. Claim 30 is rejected under 35 U.S.C. 103(a) as being unpatentable over Perahia et al (US 7,352,688 B1) in view of Poggiolini (US 5,127,066).

**Consider claim 30:**

Perahia discloses the method according to claim 20 above. However, Perahia does not specifically disclose exchanging among each other in predetermined intervals of time the polarizations of the signals sent out on the sub channels.

In an analogous art, Poggiolini teaches exchanging among each other in predetermined intervals of time the polarizations of the signals sent out on sub channels (*see Poggiolini at col. 1, lines 58-68 and col. 2, lines 1-10, where Poggiolini describes switching between two orthogonal polarization states at a frequency equal to four times the symbol frequency*).

It would have been obvious to one skilled in the art at the time the invention was made to modify the invention of Perahia, and to exchange among each other in predetermined intervals of time the polarizations of the signals sent out on the sub channels, as taught by Poggiolini, thus allowing for reducing signal fading, as discussed by Poggiolini (*see Poggiolini at col. 1, lines 15-29 and col. 1, lines 58-67*).

Art Unit: 2611

8. Claim 31 is rejected under 35 U.S.C. 103(a) as being unpatentable over Perahia et al (US 7,352,688 B1) in view of Shnitkin et al (US 3,836,973), as applied to claim 21 above, and further in view of Poggiolini (US 5,127,066).

**Consider claim 31:**

Perahia in view of Shnitkin discloses the method according to claim 21 above. However, Perahia does not specifically disclose exchanging among each other in predetermined intervals of time the polarizations of the signals sent out on the sub channels.

In an analogous art, Poggiolini teaches exchanging among each other in predetermined intervals of time the polarizations of the signals sent out on sub channels (*see Poggiolini at col. 1, lines 58-68 and col. 2, lines 1-10, where Poggiolini describes switching between two orthogonal polarization states at a frequency equal to four times the symbol frequency*).

It would have been obvious to one skilled in the art at the time the invention was made to modify the invention of Perahia, and to exchange among each other in predetermined intervals of time the polarizations of the signals sent out on the sub channels, as taught by Poggiolini, thus allowing for reducing signal fading, as discussed by Poggiolini (*see Poggiolini at col. 1, lines 15-29 and col. 1, lines 58-67*).

Art Unit: 2611

9. Claim 34 is rejected under 35 U.S.C. 103(a) as being unpatentable over Perahia et al (US 7,352,688 B1) in view of Green et al (US 5,949,762) and further in view of Glance (US 4,723,316).

**Consider claim 34:**

Perahia discloses the method according to claim 20 above. Perahia discloses sending the radio signals that are sent out on the MIMO channel , and modulating the radio signals sent out (*see Perahia at Fig. 3 and col. 5, lines 5-27, where Perahia describes a MIMO transmitter system 300 with modulator 304*).

However, Perahia does not specifically disclose (1), at least some of the radio signals are modulated and sent out by means of digital multithread, and (2), for the duration of at least one bit the polarizations of the signals sent out on the sub channels remain same.

Regarding item (1) above, Green teaches at least some of the radio signals are modulated and sent out by means of digital multithread (*see Green at Fig. 4 and col. 10, lines 1-28, where Green describes a multithread digital signal processing for a modulation process*).

It would have been obvious to one skilled in the art at the time the invention was made to modify the invention of Perahia, and to have that at least some of the radio signals are sent out by means of digital multithread, as taught by Green, thus allowing for improving system performance, as is known in the art.

Art Unit: 2611

Regarding item (2) above, Glance teaches that for the duration of at least one bit the polarizations of the signals sent out on the sub channels remain same (*see Glance at col. 4, lines 37-63*).

It would have been obvious to one skilled in the art at the time the invention was made to modify the invention of Perahia, and to have that for the duration of at least one bit the polarizations of the signals sent out on the sub channels remain same, as taught by Glance, thus allowing for phase synchronization, as discussed by Glance (*see Glance at col. 4, lines 37-63*).

10. Claim 35 is rejected under 35 U.S.C. 103(a) as being unpatentable over Perahia et al (US 7,352,688 B1) in view of Shnitkin et al (US 3,836,973), as applied to claim 21 above, and further in view of Green et al (US 5,949,762) and of Glance (US 4,723,316).

**Consider claim 35:**

Perahia in view of Shnitkin discloses the method according to claim 21 above. Perahia discloses sending the radio signals that are sent out on the MIMO channel , and modulating the radio signals sent out (*see Perahia at Fig. 3 and col. 5, lines 5-27, where Perahia describes a MIMO transmitter system 300 with modulator 304*).

However, Perahia does not specifically disclose (1), at least some of the radio signals are modulated and sent out by means of digital multithread, and (2), for the duration of at least one bit the polarizations of the signals sent out on the sub channels remain same.



Art Unit: 2611

Regarding item (1) above, Green teaches at least some of the radio signals are modulated and sent out by means of digital multithread (*see Green at Fig. 4 and col. 10, lines 1-28, where Green describes a multithread digital signal processing for a modulation process*).

It would have been obvious to one skilled in the art at the time the invention was made to modify the invention of Perahia, and to have that at least some of the radio signals are sent out by means of digital multithread, as taught by Green, thus allowing for improving system performance, as is known in the art.

Regarding item (2) above, Glance teaches that for the duration of at least one bit the polarizations of the signals sent out on the sub channels remain same (*see Glance at col. 4, lines 37-63*).

It would have been obvious to one skilled in the art at the time the invention was made to modify the invention of Perahia, and to have that for the duration of at least one bit the polarizations of the signals sent out on the sub channels remain same, as taught by Glance, thus allowing for phase synchronization, as discussed by Glance (*see Glance at col. 4, lines 37-63*).

11. Claim 36 is rejected under 35 U.S.C. 103(a) as being unpatentable over Perahia et al (US 7,352,688 B1) in view of Green et al (US 5,949,762) and further in view of Marshall et al (US 5,090,025).

**Consider claim 36:**

Art Unit: 2611

Perahia discloses the method according to claim 20 above. Perahia discloses sending at least some of the radio signals that are sent out on the MIMO channel (*see Perahia at col. 2, lines 8-25, where Perahia describes transmitting OFDM signals in the MIMO channel*); and modulating those radio signals (*see Perahia at Fig. 3 and col. 5, lines 5-27, where Perahia describes a MIMO transmitter system 300 with modulator 304*).

However, Perahia does not specifically disclose (1), modulating those radio signals by a digital multithread, and (2), the polarizations of the signals sent out on the sub channels change at least once during the duration of at least one bit of the signal.

Regarding item (1) above, Green teaches modulating those radio signals by a digital multithread (*see Green at Fig. 4 and col. 10, lines 1-28, where Green describes a multithread digital signal processing for a modulation process*).

It would have been obvious to one skilled in the art at the time the invention was made to modify the invention of Perahia, and to modulate those radio signals by a digital multithread, as taught by Green, thus allowing for improving system performance, as is known in the art.

Regarding item (2) above, Marshall teaches polarizations of signals sent out on sub channels change at least once during the duration of at least one bit of the signal (*see Marshall at col. 1, lines 40-50, where Marshall describes one half of its duration of a bit is transmitted with one polarity and the next half of its duration of the bit is transmitted with the opposite polarity*).

It would have been obvious to one skilled in the art at the time the invention was made to modify the invention of Perahia, and to have that the polarizations of the signals sent out on the sub channels change at least once during the duration of at least one bit of the signal, as taught by

Art Unit: 2611

Marshall, thus allowing for better timing, as discussed by Marshall (*see Marshall at col. 1, lines 40-50*).

12. Claim 37 is rejected under 35 U.S.C. 103(a) as being unpatentable over Perahia et al (US 7,352,688 B1) in view of Shnitkin et al (US 3,836,973), as applied to claim 21 above, and further in view of Green et al (US 5,949,762) and of Marshall et al (US 5,090,025).

**Consider claim 37:**

Perahia in view of Shnitkin discloses the method according to claim 21 above. Perahia discloses sending at least some of the radio signals that are sent out on the MIMO channel (*see Perahia at col. 2, lines 8-25, where Perahia describes transmitting OFDM signals in the MIMO channel*); and modulating those radio signals (*see Perahia at Fig. 3 and col. 5, lines 5-27, where Perahia describes a MIMO transmitter system 300 with modulator 304*).

However, Perahia does not specifically disclose (1), modulating those radio signals by a digital multithread, and (2), the polarizations of the signals sent out on the sub channels change at least once during the duration of at least one bit of the signal.

Regarding item (1) above, Green teaches modulating those radio signals by a digital multithread (*see Green at Fig. 4 and col. 10, lines 1-28, where Green describes a multithread digital signal processing for a modulation process*).

Art Unit: 2611

It would have been obvious to one skilled in the art at the time the invention was made to modify the invention of Perahia, and to modulate those radio signals by a digital multithread, as taught by Green, thus allowing for improving system performance, as is known in the art.

Regarding item (2) above, Marshall teaches polarizations of signals sent out on sub channels change at least once during the duration of at least one bit of the signal (*see Marshall at col. 1, lines 40-50, where Marshall describes one half of its duration of a bit is transmitted with one polarity and the next half of its duration of the bit is transmitted with the opposite polarity*).

It would have been obvious to one skilled in the art at the time the invention was made to modify the invention of Perahia, and to have that the polarizations of the signals sent out on the sub channels change at least once during the duration of at least one bit of the signal, as taught by Marshall, thus allowing for better timing, as discussed by Marshall (*see Marshall at col. 1, lines 40-50*).

13. Claims 44, 48, 51 and 54 are rejected under 35 U.S.C. 103(a) as being unpatentable over Perahia et al (US 7,352,688 B1) in view of Dent et al (US 6,181,920 B1).

**Consider claim 44:**

Perahia discloses the device according to claim 42 above. However, Perahia does not specifically disclose the antenna is a cross dipole.

In an analogous art, Dent teaches an antenna that is a cross dipole (*see Dent at col. 4, lines 1-12*).

Art Unit: 2611

It would have been obvious to one skilled in the art at the time the invention was made to modify the invention of Perahia, and to have that the antenna is a cross dipole, as taught by Dent, thus allowing for a low cost transmission of polarized modulated signals, as discussed by Dent (*see Dent at col. 2, lines 43-45*).

**Consider claim 48:**

Perahia in view of Dent discloses the device according to claim 44 above. Perahia discloses said facilities comprise means to change the phase situation and/or the time delay (t) of the radio signals (*see Perahia at Fig. 2 and col. 4, lines 45-53, where Perahia describes that blocks 205 shift the frequency and phase of the received signal based on the measured offset for synchronization to local timing*).

**Consider claim 51:**

Perahia in view of Dent discloses the device according to claim 44 above. Perahia discloses said facilities comprise means for dividing the radio signal into several partial signals of various performance a and 1-a (*see Perahia at col. 5, lines 5-15, where Perahia describes defining antenna element weights corresponding to the two spatial sub-channels used to transmit the signal*).

**Consider claim 54:**

Perahia in view of Dent discloses the device according to claim 44 above. Perahia describes a control facility to control the installations (*see Perahia at Fig. 2 and col. 4, lines 45-50, where Perahia describes a controller 207*).

Art Unit: 2611

14. Claim 45 is rejected under 35 U.S.C. 103(a) as being unpatentable over Perahia et al (US 7,352,688 B1) in view of Shnitkin et al (US 3,836,973), as applied to claim 43 above, and further in view of Dent et al (US 6,181,920 B1).

**Consider claim 45:**

Perahia discloses the device according to claim 43 above. However, Perahia does not specifically disclose the antenna is a cross dipole.

In an analogous art, Dent teaches an antenna that is a cross dipole (*see Dent at col. 4, lines 1-12*).

It would have been obvious to one skilled in the art at the time the invention was made to modify the invention of Perahia, and to have that the antenna is a cross dipole, as taught by Dent, thus allowing for a low cost transmission of polarized modulated signals, as discussed by Dent (*see Dent at col. 2, lines 43-45*).

***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to LIHONG YU whose telephone number is (571) 270-5147. The examiner can normally be reached on 8:30 am-7:00 pm Monday-Friday.

Art Unit: 2611

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Shuwang Liu can be reached on (571) 272-3036. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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/Lihong Yu/  
Examiner, Art Unit 2611  
/Shuwang Liu/  
Supervisory Patent Examiner, Art Unit 2611

Application/Control Number: 10/589,055

Page 23

Art Unit: 2611